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Mapping and Regional Estimation of Low Flows

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Several approahes have been suggested for the regional analysis of extreme hydrological events at ungauged basins. These regionalization approaches make various assumptions and hypotheses concerning the hydrological phenomena being modeled, rely on various types of continuous and non-continuous data, and often fall under completely different theories. A regional estimation procedure is generally composed of two parts: 1) identification of groups of hydrologically homogeneous catchments (or regions), and 2) application of a regional estimation method for the transfer of information from the homogeneous region to the ungauged site. Recent research points out the superiority of regional estimation procedures that are based on the neighborhood approach, such as the Canonical Correlation Analysis approach (CCA) and the Region of Influence approach (RI). However, these neighborhood approaches have not yet been developed for low flow estimation at ungauged sites. The present work describes the theoretical basis for the development of the CCA approach for the regional estimation of low flows, and presents the results of the application of this method to a data base from the Province of Quebec, Canada. Estimates obtained through this new approach are shown to be precise, unbiased and accurate. This new neighborhood-based method outperforms all other methods for the regional estimation of low flows (statistical clustering, use of L-moments, etc.). We also present in this work a new framework for the mapping and regional estimation of low-flows. This framework consists in combining statistical-hydrological methods for the estimation of flow characteristics with Geographic Information Systems (GIS) to feed these approaches with several layers of physiographic and meteorological numerical maps. GIS allows also the automatic delineation of drainage basins based on numerical digital elevation maps and the production of a full mapping of low flow characteristics in gauged and ungauged basins.